Intelligent condition monitoring and anomaly detection on wind farm based on a Bi-LSTM Autoencoder

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Résumé

Intelligent condition monitoring and anomaly detection approaches have become a crucial key for improving safety and reliability of Renewable Energy Systems (RES). However, many challenges arise when dealing with high dimensional datasets especially with regards to sequential and long-term temporal dependencies aspects within RES and the complexity imposed by the time dimension. To cope with these challenges, we propose a generic anomaly detection data driven Bi directional Long Short Term Memory (LSTM) AutoEncoder (AE) based approach which is able to consider temporal features on Multivariate Time Series (MTS). The proposed approach relies on a sliding window strategy and a dedicated exploratory test which led to the calculation of an accurate anomaly score representing the reconstruction error of the Bi-LSTM-AE capable of efficiently detecting faults in five identical wind turbines. The experimental results applied on real Supervisory Control and Data Acquisition (SCADA) system of a wind turbines farm, show the efficiency of the developed anomaly detection model to be trained on Normal Operation Mode (NOM) data from one turbine and generalized to detect anomalies in the other identical turbines in the wind farm.

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